CLAIMS

1. A power toothbrush comprising a brush head and an actuator for moving the brush head, wherein

the actuator further comprises a drive shaft to which the brush head is fitted, a first magnetic circuit for reciprocally moving the drive shaft in an axial direction thereof, and a second magnetic circuit for reciprocally rotating the drive shaft around the center axis thereof; and

the first magnetic circuit and the second magnetic circuit directly move the drive shaft.

2. The power toothbrush in accordance with claim 1, wherein

the first magnetic circuit and the second magnetic circuit can be activated, simultaneously.

3. The power toothbrush in accordance with claim 1, wherein

alternative of the first magnetic circuit and the second magnetic circuit can be activated.

4. The power toothbrush in accordance with claim 1, further comprising:

an inverter for generating two driving currents having predetermined frequencies and a phase difference therebetween, and supplied to the first magnetic circuit and the second magnetic circuit.

5. The power toothbrush in accordance with claim 4, wherein

the driving currents are alternating currents or pulsating currents.

6. The power toothbrush in accordance with claim 4, wherein the frequencies of and/or the phase difference between the driving currents supplied to the first magnetic circuit and the second magnetic circuit are/is adjustable.

7. The power toothbrush in accordance with claim 4, wherein the driving currents supplied to the first magnetic circuit and the second driving circuit are in phase.

8. The power toothbrush in accordance with claim 4, wherein the phase difference between the driving currents supplied to the first magnetic circuit and the second driving circuit is $\pi/2$ or $\pi/4$.

9. The power toothbrush in accordance with claim 4, wherein a frequency of a driving current supplied to the first magnetic circuit is equal to or an integral multiple of a frequency of a driving current supplied to the second magnetic circuit.

10. The power toothbrush in accordance with claim 4, wherein

a frequency of a driving current supplied to the second magnetic circuit is equal to or an integral multiple of a frequency of a driving current supplied to the first magnetic circuit.

11. The power toothbrush in accordance with claim 4, wherein

a ratio of a larger one in the frequencies of the driving currents supplied to the first magnetic circuit and the second driving circuit with respect to a smaller one of them is not an integer.

12. The power toothbrush in accordance with claim 1, wherein

the first magnetic circuit further comprises a first permanent magnet unit fixed on the drive shaft, a pair of first stators and a pair of first winding respectively wound around the first stators;

the second magnetic circuit further comprises a second permanent magnet unit fixed on the drive shaft, a pair of second stators and two pairs of second winding respectively wound around poles of the second stators;

the first permanent magnet unit is linearly moved in the axial direction of the drive shaft while a driving current is supplied to the first windings; and

the second permanent magnet unit is rotated around the center axis of the drive shaft while a driving current is supplied to the second windings.

13. The power toothbrush in accordance with claim 12, further comprising

a pair of coil springs for applying pressing forces for positioning the first permanent magnet unit and the second permanent magnet unit at initial positions while the actuator is not activated.

14. The power toothbrush in accordance with claim 13, wherein

the first magnetic circuit is periodically driven by switching on and off of supplying driving current; and

the reciprocal movement of the drive shaft in the axial

direction is sustained owing to sympathetic vibrations of the coil springs while the driving current is not supplied to the first magnetic circuit.

15. The power toothbrush in accordance with claim 13, wherein

the second magnetic circuit is periodically driven by switching on and off of supplying driving current; and

the reciprocal rotation of the drive shaft around the center axis of the drive shaft is sustained owing to sympathetic vibrations of the coil springs while the driving current is not supplied to the second magnetic circuit.